A Radical Journal of Geography
ANTIPODE


# Moving the Rain: Settler Colonialism, the Capitalist State, and the Hydrologic Rift in California's Central Valley

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**Abstract:** Agricultural development and water infrastructure constitute the central features of California's Central Valley. Marxist ecological theory has examined the development of capitalist agriculture in the Central Valley, while decolonial scholarship has critiqued the disproportionate impact of California's water resource management on Indigenous communities. We bring together Marxist ecology and critiques of settler colonialism through an examination of land reclamation in California, culminating in the development of the Central Valley Project (CVP) in the 1930s. Reclamation combined the twin logics of capitalism (accumulation) and settler colonialism (elimination) to produce landscapes conducive to capitalist agriculture. Faced with ecological limits to accumulation, colonial-capitalist expansion required state intervention in the form of infrastructure projects to secure water for agricultural production. The CVP generated a rift in California's hydrologic cycle, causing significant declines in water quality and fisheries and giving rise to forms of resistance and restoration that challenge colonial-capitalist water development in the Central Valley. The reciprocal restoration of salmon fisheries offers a method to begin mending this hydrologic rift while disrupting ongoing settler colonial violence in California.

**Keywords:** hydrologic rift, settler colonialism, capitalist state, reclamation, water infrastructure

## Introduction

Agricultural development and its associated environmental transformation in California's Central Valley has long been the subject of study by geographers, environmental historians, and political ecologists. Across disciplines and methodological approaches, scholars have connected the capitalist forms of agriculture in the Central Valley—characterised by expropriation, private property regimes, labour exploitation, and accumulation for a small class of landowners—to environmental degradation, particularly that driven by water development (Arax 2019; Isenberg 2005; Pisani 1984; Reisner 1993; Walker 2004; Worster 1985). The tensions between California's massive agricultural output (covering 25

million acres of land and worth $49.6 billion [CDFA 2019]) and a cascade of so-called "water problems" including drought, salinity, groundwater overdraft, and the uneven distribution of precipitation is central to understanding the political ecology of the Central Valley. We situate the development of California water policy in its capitalist and settler colonial context by examining processes of land reclamation and the development of the Central Valley Project in California from the late 19th century through the 1930s.

The pursuit of reliable and convenient water supplies to support capitalist agriculture has driven dramatic transformations across California's landscapes: wetlands and semi-arid lands were enclosed, cleared, drained, irrigated, and conscripted into circuits of agricultural production under the banner of *reclamation* (see Adams 1917, 1933; Etcheverry 1933). However, a combination of drought (in which the demand for water exceeded available supplies during dry years)[1] and groundwater overdraft eventually limited the expansion of agriculture in the southern Central Valley and threatened the success of reclamation. In order to "salvage" drought-threatened lands, the state intervened to construct the Central Valley Project (CVP), a massive network of water infrastructures intended to provide reliable and subsidised irrigation flows for agriculture in the Central Valley (Arax 2019; Pisani 1984; Reisner 1993; Worster 1985). The CVP reconfigured the Sacramento and San Joaquin watersheds, a major and unprecedented disruption to the hydrology and ecology of the Central Valley, which we conceptualise as a metabolic rift (Foster 1999) in the hydrologic cycle, or a hydrologic rift. We employ metabolic rift theory alongside other theories of Marxist ecology, particularly Smith's (2008) production of nature thesis and O'Connor's (1998) notion of the second contradiction of capitalism, to analyse the capitalist mechanisms of environmental degradation in the Central Valley.

Yet there remains a conspicuous absence in much Marxist ecology broadly, and in the literature on agriculture and water development in the Central Valley specifically: settler colonialism goes largely unmentioned. When acknowledged, settler colonialism and the dispossession of California's Indigenous peoples are typically presented by way of reference to past violence (e.g. Arax 2019; Isenberg 2005; Reisner 1993; Worster 1985). However, settler colonialism operates not as a series of historical events, but as a structure of elimination and dispossession that remains operative today (Coulthard 2014; Wolfe 2006). Indigenous communities continue to survive and resist colonialism in California and have consistently led struggles against environmentally destructive water developments. Recent works by Dallman et al. (2013), Middleton-Manning et al. (2018), Woelfle-Erskine (2019), and Yazzie and Risling-Baldy (2018) demonstrate the centrality of settler colonialism to California water politics and highlight the contemporary resistance of Indigenous peoples against violent water policies. While these scholars do include critiques of capitalist production, critiques of settler colonialism and ecological Marxist theory have generally remained siloed when examining water development in the Central Valley.

It is our aim in this paper to bring together Marxist theories on capitalist agriculture and nature-society relations and critical theorisations of settler colonialism through an examination of land reclamation and the production of water

infrastructure in late 19th and early 20th century California. The paper proceeds in four sections. First, we discuss the relationship between the central logics of capitalism (accumulation) and settler colonialism (elimination) and the ways in which these entwined logics produced new forms of nature via land reclamation. Next, we provide a brief history of the ways in which reclamation was bound up with the settler colonial imaginary in the Central Valley through land policies. Third, we discuss how the limits of reclamation, reached by private capitalist interests in the early 20th century, spurred new state discourses, practices, and investments in "rational" water development and the CVP. Finally, we examine the processes through which the CVP produced a hydrologic rift in the Central Valley, generating immense ecological destruction in the realms of water quality and anadromous fisheries. We conclude by turning towards forms of reciprocal restoration advocated for by Indigenous communities who are challenging the expansion of colonial-capitalist water infrastructure. We posit that the reciprocal restoration of salmon fisheries offers a method to mend the hydrologic rift while simultaneously disrupting ongoing colonial violence and promoting Indigenous futurities.

Through our examination of the CVP, we hope to address two pressing politico-theoretical concerns. First, by linking scholarship on settler colonialism and Marxist ecology, we provide one way in which these radical traditions can better speak to one another, and more importantly, contextualise the *ongoing* impacts of colonial-capitalist water policy on California's anadromous fisheries and Indigenous communities. Second, we argue that metabolic rift theory—while providing an innovative analytical framework—aims at a universal understanding of the capital-nature relation (that capitalism always generates destructive rifts) and in so doing grants overwhelming power to capital as a destructive force. The case presented here demonstrates that capital did indeed come up against "limits" in the era of reclamation, which could only be overcome by concerted intervention from the colonial-capitalist *state* marshalling the power of science, expertise, and engineering to construct what was, at the time it was built, the largest infrastructure project in the world. Putting emphasis on the role of the colonial-capitalist state in the production-cum-destruction of nature allows for the possibility that the social and ecological consequences of the hydrologic rift were not inevitable, but are products of a specific political project and therefore remain open to contestation.

## Ecological Elimination and the Production of Reclaimed Natures

The expansion of agriculture and other capitalist industry in California has resulted in extensive environmental change. Since colonisation in the 1840s California has lost up to 95% of its grasslands and chaparrals, 91% of its wetlands, 97% of its accessible coldwater tributary habitat, and 95% of its old growth forests (Dahl 1990; Farley et al. 1993). Approximately 74% of California's native salmonids face extinction within the next century, and the predictions for insects, birds, and amphibians are similarly bleak (Moyle et al. 2011, 2017). These statistics on habitat loss and landscape change have often been framed as the push of civilisation

into wilderness, the conscription of an untouched nature into the circuits of capital, but this is not quite accurate: California's grasslands, wetlands, oak chaparrals, and old growth forests were not *wilderness* at all. Rather, these ecologies have been shaped for millennia by Indigenous peoples and practices, including selective burning, planting, harvesting, and hunting through which kinship relationships between humans and nonhuman beings are maintained and revitalised (Anderson 2005; Martinez 2003; Norgaard 2019). We draw from the definition of *ecologies* presented in Whyte et al. (2018:159) encompassing arrangements of humans, nonhuman beings, inanimate entities, and landscape and climatological features "that are conceptualised and operate purposefully to facilitate a society's capacity to survive and flourish". Changes wrought upon Indigenous ecologies have disrupted kinship networks and enabled settler occupation and capitalist production in California. With this in mind, we understand that interrogating the function of settler colonialism in structuring environmental change is not a separate task from analysing the capitalist development of water resources in the Central Valley.

We link the critiques of settler colonialism and capitalist development through the process of *reclamation*: the production of agricultural property via the enclosure and elimination of wetlands and semi-arid landscapes. Reclamation in California cannot be disentangled from the settler colonial dispossession of Indigenous peoples, as all agricultural and water development in the state is contingent upon the expropriation of land. Settler colonial expansion can generally be understood as motivated by the capitalist growth imperative, while capitalist production in California relies in turn upon settler colonial control of land and water resources. The development of California as a settler colonial state and the development of California as a capitalist state are thus two sides of the same project: to control the land and make it profitable. Where capitalism operates according to the logic of endless accumulation, settler colonialism operates according to the logic of elimination.[2] In his seminal work on settler colonialism, Wolfe (2006:388) notes that "the primary motive for elimination is not race (or religion, ethnicity, grade of civilisation, etc.) but access to *territory*". That is, the central tenant of settler colonialism is the control of land and its accompanying water, mineral, and biological resources. Through elimination, settlers seek to occupy Indigenous lands and replace Indigenous societies with their own specifically capitalist modes of production and ecological regimes. Settler colonial elimination provides the basis of primitive accumulation, or accumulation by dispossession, in settler colonial societies such as the United States of America, and at a smaller scale, in California.

The logic of elimination motivated the murder, enslavement, and displacement of thousands of Indigenous people during the California Genocide of 1846–1873 and continues to drive policies that perpetuate erasure, assimilation, and dispossession today (Kingston 2015; Madley 2016; Norgaard 2019). Elimination does not just refer to the attempted annihilation of human populations, but also encompasses the destruction of Indigenous ecologies, nonhuman relatives, and kinship networks. The California Genocide was "coupled with a reorganisation of the natural world and an assault on a spiritual order that nourished and governed

an entire field of ecological relationships" (Norgaard 2019:17). Drained wetlands, clear-cut forests, muddied and diverted streams, and decimated fisheries are the products of settler colonial elimination as much as missions and massacres. As Tuck et al. (2014:19) conclude, "settler colonialism has not only violently interrupted Indigenous life, but it has resulted in quick and brutal environmental degradation". Wolfe (2006:388) further explains that the logic of elimination has positive and negative dimensions: "Negatively, it strives for the dissolution of native [sic] societies. Positively, it erects a new colonial society on the expropriated land base". The project of reclamation embodies this "positive" dimension of elimination: settlers considered unreclaimed wetlands and deserts to be lacking and in need of correction and so replaced Indigenous ecologies with rangelands, orchards, canals, and reservoirs. The construction of settler society thus requires not only ecological elimination, but the *production* of nature.

Smith's (2008) production of nature thesis thus compliments Wolfe's insight into the "positive" aspects of settler colonial transformation of territory. Ecologies are not merely decimated under colonial-capitalist expansion, but fundamentally remade to serve the interests of colonial-capitalist empire. In the production of nature under capitalism, the material use-values of natures, ecosystems, ecologies are rendered valuable only if they can be put to use in the generation and extraction of surplus-value in the production process, and are thus ultimately subordinated to the abstract logic of exchange value. It is this "abstract logic that attaches to the creation and accumulation of social value which determines the relation with nature under capitalism … under dictate from the accumulation process, capitalism as a mode of production must expand continuously if it is to survive. The reproduction of material life is wholly dependent on the production and reproduction of surplus value" (Smith 2008:70−71). Given this unceasing drive for expansion and the transformation of natures into exchange value, capitalism expands "under the banner of benevolent colonialism … sweep[ing] before it all other modes of production, forcibly subordinating them to its own logic" (Smith 2008:71). Here Smith notes that the colonial expansion of capitalism is predicated on subordinating all previous modes of production, ways of life, uses and values of land to production defined by expropriation, exploitation, the appropriation of surplus, and the creation of exchange value that enables the endless accumulation of capital.

Reclamation was the primary mechanism through which large swaths of land were converted to capitalist agricultural production in California. The parallel concepts of *terra nullius* and *terra economica* illustrate the function of reclamation in the development of California as a colonial-capitalist state. The tule marshes and semi-arid scrublands of the Central Valley, when understood as *terra nullius* (Tuck et al. 2014), appeared to settlers as empty land open for the taking despite the habitation of these lands by Indigenous peoples since time immemorial. To capitalists, the "deserts" and "swamps" of the Central Valley represented *terra economica* (Goldstein 2012): land that is wasted but could be rendered valuable if enclosed; land that is potentially, but not-yet, commodified. Reclamation represents an intersection between *terra nullius* and *terra economica*, and thus between colonial and capitalist mandates broadly: to occupy the land and make it

productive. Without reclamation, the Central Valley could never have supported widespread agricultural production and state officials worried that "the centre of gravity of the population of the United States … [would] not move westward of the Mississippi" (Hall 1876:30). Early agribusiness interests, meanwhile, insisted that unless saturated land was drained and arid land was irrigated, the landscapes of the Central Valley could have "no human value" (Adams 1933:3). The reclamation of the Central Valley was crucial to the success of California's economic development and to the continued territorial expansion of American settlement and Manifest Destiny more broadly.

However, the colonisation and commodification of land in the Central Valley quickly ran up against a common limiting factor: the availability of water. "When Nature laid down the mountains, valleys, and streams that form the Golden State, she provided water resources that are, in toto, probably ample for its needs", opined journalist Stuart Blythe in 1937. "But she impishly arranged matters so that the land resources and the water resources are *out of balance*" (ibid., emphasis added). Such a sentiment appears frequently throughout the literature on water in California: the availability of water under California's natural hydrologic regimes has often been framed in terms of "inequality" or "maldistribution", where there is simply too much water in some places, and not enough in others (Figure 1). It quickly became clear that if agriculture was to be profitable, water would simply have to be moved to meet demand.

## Reclamation, Irrigation, and Land Colonisation

Reclamation was promoted by a series of state and federal policies which offered settlers title to marginal lands in California if those lands were converted to irrigated agricultural production. The extensive tule marshes and semi-arid scrublands of the Central Valley had initially deterred Spanish colonists and posed a similar challenge to American settlers. One Bureau of Reclamation (1941) pamphlet describes "an adventurous band of Spanish soldiers" pursuing a group of Native men and catching a glimpse of the Central Valley: "they found it a desolate expanse of part desert and part swamp and turned back to the coast, leaving the valley to the Indians". The underlying logic of the pamphlet is clear: unless the Central Valley was reclaimed through irrigation, it might as well be left to Indigenous peoples, which would mean the failure of settler colonialism in California. The reclamation of the Central Valley was crucial to the success of colonial-capitalism in California.

In 1852, Congress rejected over a dozen treaties signed with Indigenous nations in California on the basis that the land *already* belonged to the United States under the Treaty of Guadalupe Hidalgo. Without treaty ratification, the federal government maintained that Indigenous communities "had no usufructuary or other right therein", and sold land to settlers as quickly as possible (Anderson et al. 1978). When the labour- and capital-intensive task of reclamation posed a considerable barrier to prospective settlers, the state and federal governments intervened to make arid land and wetlands available for purchase at exceedingly low prices. The 1855 Swamp Lands Act offered "cheap" wetlands and overflow

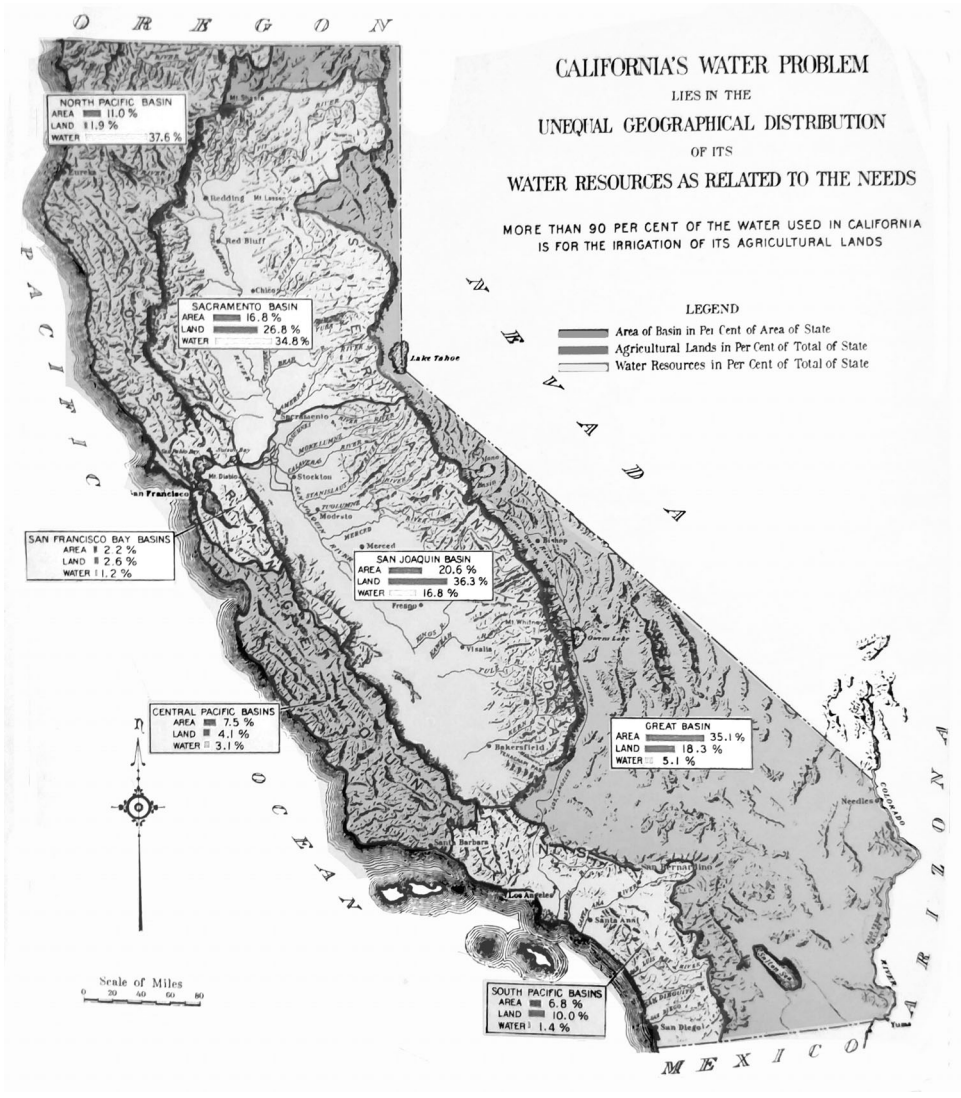


**Figure 1:** California's Water Problem (from Rolph 1931, courtesy Special Collections of the Sacramento Public Library)[6]

lands to settlers with title *contingent upon reclamation*. The 1877 Desert Land Act operated on a similar premise, promising settlers up to 625 acres at $1.25 each as long as the purchaser constructed a residence and irrigation system within three years. But although boosters promised settlers deep rich soils and a mild climate, new arrivals to California's San Joaquin Valley were frequently disappointed by poor soil quality and inconsistent rainfall. When William Hammond Hall was appointed to be California's first State Engineer in 1878, he became a leading proponent of irrigation (which he often referred to as "land colonisation") to solve the issue of this discrepancy between settler expectations and the land itself.

The development of irrigation as a colonial endeavour is hardly unique to California, and Hall considered irrigation to be the distinguishing feature of colonial empires worldwide, frequently referencing the success of British irrigation efforts —in Egypt, India, Palestine, Southern Africa—in his reports to the California legislature (Hall 1891). To convert arid environments and wetlands to agriculture was, in Hall's eyes, necessary for "civilisation" to flourish. Under Hall's leadership, the irrigation of "deserts" and "swamps" gained special significance in the state's efforts to facilitate settlement in California's Central Valley. In 1886, the State of California lifted acreage restrictions on the sale of swamp and overflow lands entirely, allowing speculators to purchase land without limit as long as they could afford to reclaim and irrigate it, leading to the concentration of reclaimed lands in the hands of a wealthy class of capitalists. This is consistent with Marx's (1990:938) observation that cheaply priced land grants are the "great secret of colonisation". Taken together, these policies codified *deserts* and *swamps* as negative landscape features in need of correction (*terra economica*). By offsetting the cost of reclamation in the region, the state successfully aided the conversion of wetlands and semi-arid lands into agricultural landscapes.

During approximately the same time period that the state facilitated the enclosure of semi-arid lands and wetlands in California, it also funded and directed the California Genocide. Between 1846 and 1873, the State of California and the federal government of the United States spent a combined total of more than $1,700,000 on military endeavours, militia campaigns, and bounties in an indiscriminate campaign of annihilation against California's Indigenous peoples and ecologies (Lindsay 2012; Madley 2016). The human scale of the California Genocide is staggering. Prior to colonisation, over 300,000 Indigenous people lived in the land that is now California. Hupa scholar Jack Norton (1979:108) estimates that fewer than 30,000 Indigenous people survived in California after the peak of violence in 1870, then fewer than 16,000 people by 1900. Beyond outright murder, mutilation, and enslavement, settlers also poisoned and destroyed food sources and displaced entire communities, so that the California Genocide functioned as a "violent dislocation … [to] kinship relationships across species" and resulted in "the radical reoganisation of wealth and ecology" across California (Norgaard 2019:47).[3]

In conjunction with land grants, the California Genocide enabled increasing settler control of land so that the production of reclaimed natures expanded at a rapid pace across the Central Valley. The Tulare Lake basin was drained and converted to agricultural production, turned to wheat and then tomatoes and almonds; stonefruit and citrus replaced scrub brush and bunch grasses slowly, then all at once. Levees were built to contain the Sacramento and Feather Rivers in an attempt to keep floodwaters and mining debris from ravaging new fields. By the early 1900s, approximately 5,000,000 acres in California had been irrigated for agricultural production, triple the irrigated land in 1880 (Etcheverry 1933; Harding 1960). This dramatic expansion of irrigated acreage was accompanied by parallel declines in wetland, grassland, and chaparral habitats. Moreover, it required extensive replumbing of the state's hydrology: scientists and engineers working for private companies and local governments alike found ways to

mitigate floods, drain moisture from soils, pump streams into new channels, and extract groundwater to support agriculture in increasingly marginal lands at increasingly intensive scales (see Carroll 2012; Walker 2004). The success of reclamation via irrigation was existentially contingent upon the development of new forms of scientific knowledge production which could facilitate the expansion of water infrastructures to secure agricultural production against drought and flood.

But by the early 1920s, the pace of reclamation had slowed. A series of droughts in 1876–77, 1898–99, 1917–21, and 1921–23 strained agricultural production, and irrigators with poor groundwater access saw significant declines in yield. Headlines warned that farmers might have to pack up and abandon their reclaimed lands *en masse*, that further expansion would be impossible, that the whole area was bound to simply dry up and blow away. In 1931, the Governor of California James Rolph cautioned that "200,000 acres of highly developed land ultimately … [would] revert to desert if not furnished with a dependable supplemental supply [of water]". Without the provision of new sources of water, the production of reclaimed natures had reached its limit. Yet, as Marx (1993:334) notes, "capital is the endless and limitless drive to go beyond its limiting barrier. Every boundary is and has to be a barrier for it". Environmental limits, such as the availability of water, thus appear to capital as mere barriers to be overcome with improved technological control over the landscape. By the early 1900s, most reclamation and irrigation projects feasible under private construction had already been completed (Adams 1917; Mead 1903). Reaching the limits of reclamation produced a twofold crisis for the colonial-capitalist state: a fundamental economic crisis for agricultural capital, and a politico-ideological threat to the expansion of the settler colonial project. Neither could be addressed by individual capitalists nor even by capital acting in its own class interests—the crisis required direct intervention and organisation by the capitalist state.

## The Central Valley Project and the Capitalist State

The development of irrigation infrastructure at the scale of out-of-basin transfers, which would be necessary to continue agricultural accumulation, had escaped even the wealthiest of agribusiness and ranching interests. When the demand for water exceeded available supplies and threatened agricultural capital, the state stepped in to manage the crisis by constructing the Central Valley Project. While suggestions for state involvement in irrigation broadly can be traced back to William Hammond Hall, the idea for the CVP itself originates in a 1919 proposal authored by Colonel Robert Bradford Marshall, a former topographer who championed the coordinated and rational development of water resources in California. The Marshall plan centred a large dam to regulate the flow of the Sacramento River and to provide irrigation flows to the semi-arid regions of the Central Valley, simultaneously easing the constraints imposed on growth by water scarcity and bringing together the hundreds of disparate irrigation projects in a unified system of water resource management. Drawing heavily from Marshall, State Engineer Edward Hyatt submitted a revised proposal for water conveyance infrastructure to the California legislature in 1931. Hyatt's ambitious proposal included 24

reservoirs, six canals, three large watersheds, and a price tag of over $5,000,000. Like Marshall, Hyatt's plan for the CVP would impound water in northern California and in the western slopes of the Sierra Nevada Mountains, and subsequently pump it hundreds of miles south to meet the growing demand for water in the San Joaquin Valley. The proposal was put to vote in a 1933 referendum, the citizens of California voted in favour of the Project by a narrow margin, and the federal government authorised the CVP in 1935 under the management of the Bureau of Reclamation in line with the New Deal emphasis on dam construction as a method of economic development (Engle 1956; Reisner 1993).[4]

The limits of capitalist reclamation and water management required the state to intervene in, remake, and vastly expand the "conditions" of capitalist production. Marx conceptualised the material conditions of production (labour, land and nature, infrastructure) as fundamental to the production of value (O'Connor 1998:144). This informed Polanyi's (1944) notion of fictitious commodities: aspects of socio-ecological life that cannot be produced as commodities but must be treated *as if* they were. This fiction generates a fundamental tension: conditions of production are central to capitalist growth, but the attempt to overcome ecological limits to productivity by subjecting nature to the logics of exchange value tends to underproduce (degrade, exhaust, pollute) these very conditions (O'Connor 1988, 1998). The management and repair of the conditions of production cannot, therefore, fall to capital but rather comes under the purview of capitalist states (O'Connor 1998:148). O'Connor understands the state as a social relation defined by multiple, competing material interests; thus, the definition and management of ecological crises are open politico-ideological questions: "'ecological crisis' is as much (or more) a political and ideological category as it is a scientific construct" (1998:137). Whether or not capital faces "'external barriers' to accumulation and whether or not these 'barriers' take the form of economic crisis; and whether or not economic crisis is resolved in favour of or against capital are sociopolitical and ideological questions first, and socioeconomic questions only secondarily" (O'Connor 1998:165). That is, the primary struggles revolve around whether and how the state recognises and defines the scope of ecological crisis and is compelled (or not) to marshal regulatory, financial, or technological forms of crisis management (see Surprise 2018).

The State of California deemed the perceived scarcity and imbalance of water in the Central Valley a crisis that required massive infrastructural intervention into the landscape. Shortly before the initial developments of the CVP were authorised, California Governor James Rolph issued a "Message to the People of California Dealing With Their Water Problem". In the "Message", Rolph (1931:4) declared that agricultural water shortages, in which the over-allocation of streams resulted in a demand for water that outstripped availability during dry years, were a "real emergency" threatening economic production and settlement alike. Rolph, on behalf of the state, subsequently assumed "the duty of relieving the acute situation caused by the uneven distribution of our water resources". The construction of waste lies at the heart of this emergency, and of California's ongoing water crisis (Cantor 2017), in which politicians and engineers have insisted that the ultimate problem is not an actual limit on water availability but the "waste" of water

left undiverted from rivers which could, if developed through surface storage and conveyance projects, be provided to agricultural users as irrigation flows. When limits to water availability threatened the success of reclamation in California, and therefore capitalist accumulation and the colonial project alike, Marshall promised that the scientific, rational development of water resources could "salvage" agricultural production in semi-arid regions and increase the value of agricultural lands across the state. To delay this development, Marshall (1919:6) wrote, would be for the state to "neglect wealth". In this way, the State of California justified its program of coordinated water development on the moral and economic imperative to conserve otherwise "wasted" water and make it readily available to agricultural capital.

This "rational development" of water resources depended upon a vast body of scientific knowledge which rendered watersheds legible to the state. Scott (1998) defines legibility as the production of scientific knowledge which translates complicated wholes into forms of simplified knowledge which the state uses to view, order, and manipulate socio-ecological life. By producing simplified, numeric data about slope and streamflow, topographic and hydrologic surveys rendered watersheds legible to the state, granting the state both the logistical capacity and the legitimacy to discipline disruptive hydrologic regimes. In this capacity, surveys were "not just maps. Rather they were maps that, when allied with state power, would enable much of the reality they depicted to be remade" (Scott 1998:3). In addition to hydrologic surveys undertaken by the USDA and USGS, California State Engineer Edward Hyatt lead surveys to inventory of over 200,000 acres of irrigable land in California specifically in order to develop a comprehensive plan for the "maximum conservation, control, storage, distribution, and application of all the waters of the state" (Hyatt 1938:391). The state's goal in producing environmental knowledge through surveys in the early development of the CVP was not to gain a deeper understanding of ecology, but to systematically collect information about the landscape that enabled the colonial-capitalist state to overcome ecological limits to accumulation.

The initial developments of the CVP hinged upon the reconfiguration of the Sacramento-San Joaquin River system (Figure 2). The Sacramento and San Joaquin Rivers, two of the largest rivers in California, both drain into the Sacramento-San Joaquin Delta, the largest estuary on the West Coast. The Central Valley Project dammed the Sacramento and San Joaquin Rivers at their headwaters, behind Shasta and Friant Dams respectively. Below Friant Dam, the San Joaquin River, appropriated almost entirely for irrigation, is pumped north in the Madera Canal and south in the Friant-Kern Canal. Before it can run out through the Delta, water from the Sacramento River is pumped uphill into the Delta-Mendota canal, where it fulfils the water rights of appropriators previously accustomed to drawing from the (now greatly reduced) San Joaquin River. The Contra-Costa canal provides fresh water from the Sacramento River to Delta-region contract holders. Two dams, a handful of pumping stations, countless transmission lines, and 393 miles of canals later, state engineers believed that they had corrected the so-called "imbalance of nature". Journalists, legislators, and state officials rejoiced that the CVP had solved California's water problem by simply "moving the rain" (White 1940).


**Figure 2:** Initial Developments of the Central Valley Project (from Water Project Authority 1941:11, courtesy Special Collections of the Sacramento Public Library)

This sprawling water infrastructure network produced strictly managed riverine and riparian natures while also enabling the ongoing production of reclaimed natures by securing and expanding irrigation flows. In addition to perpetuating the production of reclaimed natures via the elimination of Indigenous ecologies, CVP operations perpetuated settler colonial dispossession: Shasta and Friant flooded the land of the Winnemem Wintu and the North Fork Mono respectively, and the Bureau of Reclamation never compensated the Winnemem Wintu for the dozens of tribal allotments that were submerged, bulldozed, or transferred to Forest Service management during CVP construction (Dallman et al. 2013; Sisk 2001).

Additionally, the initial developments of the CVP blocked the majority of coldwater tributary habitat in the state and prevented salmon from reaching their spawning grounds, which significantly disrupted salmon-based lifeways and modes of resistance (e.g. the Wintu negotiation of labour and land at Baird Hatchery [Smith 1995; Woelfle-Erskine 2019]). The expansion of agricultural capital facilitated by the CVP was thus predicated upon the dispossession and displacement of Indigenous communities in California.

By mobilising state and federal funding, scientific expertise, engineering and infrastructural power, the state fundamentally transformed landscapes, watersheds, and river flows to overcome the "limits" of water availability, fulfilling the needs of agricultural capital whose power had become hegemonic to the point that its interests were the "universal" interests of the Californian colonial-capitalist state. In facilitating the extraction, storage, and conveyance of water through the construction of the CVP, the state not only dispossessed Indigenous communities but also effectively separated the site of precipitation from the site of water consumption in the Central Valley, which generated a metabolic rift (Foster 1999) in the hydrologic cycle.

## From Hydrologic Rift to Reciprocal Restoration

Metabolic rift theory, which conceptualises ruptures in biogeochemical cycles as a function of capital's tendency to circumvent ecological limits to accumulation, allows us to see the connections between depletion and pollution at various sites within capitalist ecologies. In their work on metabolic rift theory, Foster et al. (2010) draw on Marx's reading of Justus von Liebig to examine disruptions to the soil nutrient cycle under capitalist agriculture. Marx (1991:949) writes that by producing food for exchange, so that the site of consumption is increasingly separated from the site of production, capitalist agriculture "produces conditions that provoke an irreparable rift in the interdependent process of social metabolism". This insight provides the foundations of metabolic rift theory. Considering metabolic rifts in soil nutrient cycling, Foster et al. (2010) identify three key processes which contribute to the squandering of soil fertility: crops shipped long distances do not return their nutrients to their soils of origin; these nutrients accumulate elsewhere as pollution and waste; and new scientific and technological developments increase the intensity of capitalist exploitation of the soil at ever-greater scales.

Metabolic rifts are not isolated, but in dynamic movement with interdependent ecological and social systems. As Foster et al. (2010) describe, the metabolic rift in the nitrogen cycle that caused declines in European soil fertility was entangled with the forced labour practices of the Peruvian guano industry and, more recently, the spread of dead zones and algal blooms caused by excessive fertiliser use. Climate change, meanwhile, is symptomatic of a metabolic rift in the carbon cycle wherein accumulated organic carbon deposits are combusted as fossil fuels and subsequently concentrate in the atmosphere, while deforestation and ocean warming reduces the efficacy of carbon sinks. Overfishing, understood in terms of the commodification and extraction of marine life, disrupts energy flows through

trophic levels. This biological rift manifests in the collapse of ocean ecosystems simultaneous to the accumulation of pollution and the proliferation of disease in aquaculture operations (Longo et al. 2015). Applied to the hydrologic cycle, metabolic rift theory connects the development of water resources to serious declines in water quality and the collapse of anadromous fisheries.

As with soil nutrients, the metabolic rift in the hydrologic cycle—or the hydrologic rift—can be generally characterised by the extraction of a resource and its transport to distant sites of consumption, driven by scientific and technological advancements which facilitate agricultural production at ever-greater scales. As state engineers disciplined the hydrologic regime of the Central Valley by dam and canal in order to meet the needs of capitalist agriculture, they reduced the flow of water to sustain riverine, riparian, and estuarine ecosystems. Instead, river water was diverted to irrigated fields in far-away watersheds where it mobilised salts which accumulated as pollutants in return flows and poorly-drained soils (Prokopovich 1989). Increased irrigation led to increased production and the increased export of water stored in crops to far-away markets. The mass extraction and transport of water, causing depletion in the Sacramento and San Joaquin watersheds simultaneous to the accumulation of pollutants in Central Valley soils and waters, is the basis of hydrologic rift. Ultimately, the state's intervention in California's hydrologic regimes has caused a series of interrelated ecological unravellings—primarily in water quality and fisheries—which we posit are symptomatic of the hydrologic rift.

CVP operations have significantly impacted water quality in the Central Valley. Lower flows and warmer waters, a result of irrigation diversions and reservoir discharge, have resulted in the proliferation of harmful algal blooms and aquatic diseases across CVP service areas. Water quality tests in the Delta after the first four decades of CVP operations found high concentrations of selenium, bromide salts, pesticides, and mercury, generally attributed to agricultural practices (USBR 1999). Although the 1999 CVP Improvement Act attempted to mitigate environmental damage caused by CVP operations, selenium levels in the Sacramento-San Joaquin Delta still exceed regulatory load allocations (David et al. 2015). Fertiliser use tripled in the decade after CVP operations began and has continued to increase, in part because increasingly marginal soils had been cultivated through irrigation and were quickly exhausted of their nutrients (Reisner 1993; Walker 2004). Irrigation in CVP service areas mobilises these fertilisers as nutrient pollution, contributing to harmful algal blooms which continue to impact water quality in the Central Valley and Bay-Delta region (Rosenstock et al. 2013). This nutrient pollution has also caused a deterioration in drinking water quality across the San Joaquin Valley, which has particularly affected the health of migrant workers, poor households, and communities of colour and is widely recognised as one of the Central Valley's major environmental justice issues (Balazs et al. 2011).

Among a wide range of environmental and ecological impacts, CVP operations have contributed to a dramatic decline in fisheries: without significant changes to state and federal water resource management, the majority of California's native fish species are expected to be driven extinct within a century (Moyle et al. 2017). Anadromous fish such as salmonids are particularly vulnerable since dams

have blocked migration and eliminated access to over 97% of cold-water spawning and rearing habitat in California. Dams also prevent the movement of sediment and gravel and release water at near-lethal temperatures for salmonids, leading to adverse in-stream conditions below the dams. Despite mitigation measures such as hatchery production, trucking, and gravel additions, 15 of the 18 distinct populations of the Central Valley spring run Chinook have become extinct or extirpated since the CVP began operations (Black 1995; Moyle et al. 2011). While the engineers designing the CVP drew from decades' worth of topographic and hydrologic surveys, fish surveys did not begin until after the project was authorised. When the question of how the Central Valley Project might impact the runs of anadromous fish in the Sacramento-San Joaquin River system was first raised in 1938, the Bureau of Reclamation's chief engineer admitted ignorance, saying that he "did not know that this problem would be so important" (Pesonen 1953).

The decimation of the Central Valley's salmon fishery is of particular concern to Indigenous communities in California, many of whom have kinship responsibilities to salmon. Salmon are considered both ecological and cultural keystone species, and the decline of salmon runs has serious implications for the health, cultural integrity, and overall wellbeing of the salmon-based communities that depend upon California's rivers (Garibaldi and Turner 2004; Norgaard 2019). Indigenous communities have resisted the CVP since its first developments, and Indigenous activists continue to lead movements linking water and salmon to tribal sovereignty in California. Advocates with the Winnemem Wintu Tribe and the Karuk Tribe have argued that the extinction of salmon in California constitutes cultural genocide and have subsequently called for the state to shift away from water policies which contribute to the loss of anadromous species and turn instead towards water policies that centre salmon restoration (Gali 2019; Norgaard 2019; Sisk et al. 2019). But centring water quality and the health of California's anadromous fisheries, both of which are crucial for Indigenous resurgence (Simpson 2017), is generally at odds with business-as-usual water resource management which prioritises the water demands of agricultural capital.

The CVP and the associated network of water projects which maintain the hydrologic rift embody what LaDuke and Cowen (2020:244, 253) call *Wiindigo infrastructures*, defined as the material systems which "entrench and harden the very means of settler economy and sociality into tangible material structures" while also "underpin[ning] social organisation and its reproduction in the logics of capital, property, and accumulation over life". Capitalist accumulation and settler colonial elimination thus coincide in the hydrologic rift: as the CVP enabled the continued growth of agricultural capital, it simultaneously facilitated the elimination of Indigenous ecologies by extirpating salmon populations and contributing to salmon declines across California. The hydrologic rift—the depletion of watersheds, accumulation of pollution, decimation of species—maintained by CVP operations continues to generate environmental violence.

Coulthard (2014: 60) writes that "the primary experience of dispossession" fuels "Indigenous resistance to and criticism of the colonial relationship itself: that is, Indigenous struggles against capitalist imperialism are best understood as

struggles oriented around the question of *land*". Coulthard (2014:60) continues to say that these struggles are "deeply *informed* by what the land as a mode of reciprocal *relationship* (which is informed by place-based practices and associated forms of knowledge) ought to teach us about living our lives in relation to one another and our surroundings in a respectful, nondominating and nonexploitative way". Indeed, Indigenous communities continue to survive, maintain relationships with land and water, and struggle against ecological destruction across California. Indigenous advocacy coalitions including Idle No More, the Run4Salmon, and Save California Salmon have vociferously opposed the Shasta Dam raise, the Delta Tunnel, Temperance Flat Dam, and other extractive water projects on the basis of their significant impacts on endangered salmon populations and thus their contribution to genocide (Sisk et al. 2019; Gali 2019). Indigenous organisers have also been at the forefront of salmon restoration efforts across California, such as the movement to build a fish passage "swimway" around Shasta Dam and the decades-long efforts to undam the Klamath River.

These restoration projects can achieve "reciprocal restoration", which encompasses the "repair of both ecosystem and cultural services while fostering renewed relationships of respect, responsibility, and reciprocity" through ecological restoration grounded in traditional ecological knowledge (Kimmerer 2011:258; see also Whyte 2013). Reciprocal restoration in the form of salmon restoration (including river restoration, dam removal, diversion reduction, floodplain reconnection, wetland restoration, the return of stolen land, and the reintroduction of good fire[5]) is necessary to prevent extinction and crucial to ensure resurgent Indigenous futurities (Simpson 2017; Norgaard 2019). Where existing mitigations have generally failed to prevent species decline, reciprocal salmon restoration offers a tangible method of simultaneously closing the hydrologic rift and affirming Indigenous sovereignty. Mending the hydrologic rift requires a fundamental shift in water resource management, and this offers an opportunity to renew the relationships between people and land which have been decimated by colonial-capitalism in California.

## Conclusion

Since the construction of the initial developments of the CVP, the hydrologic rift has been wrenched ever-wider: state and federal water conveyance projects operate 40 large dams and 1,200 miles of canals between them, all intended to solve California's "water problems" and deliver irrigation flows to agricultural users in perpetuity. And yet, despite these massive hydrologic interventions, the State of California declared a state of emergency over extreme drought conditions in May 2021 as low reservoir storage and a dry winter once again threaten to disrupt the state's developed water supplies and the associated agricultural profits. The billboards along the Interstate-5 today echo the newspaper headlines of the 1920s: without more water, the Central Valley might dry up and blow away. The Bureau of Reclamation *has* cut water deliveries for agricultural users this year, but the prior year's deliveries have impacted coldwater reservoir storage and as a result, fish kills are unfolding in the Sacramento and Klamath Watersheds. Frankie Joe

Myers, Yurok Tribe Vice Chairman, says that because the fish kills will have significant and long-lasting impacts on the wellbeing of Indigenous communities, "it feels like the war on Indians never ended" (Yurok Tribe 2021).

Irregular precipitation, warming temperatures, and reduced snowpack all pose an increased threat to at-risk salmon, and all have been long-anticipated effects of climate change in California. But the state and federal governments alike have responded to this new climate-induced water crisis by doubling down on a business-as-usual approach to water development in California: build more dams, increase surface storage, and then pump more and more water to fulfil larger and larger water contracts (e.g. the Shasta Dam raise, Sites Reservoir, Temperance Flat Dam, and the Delta Tunnel). As these projects advance, they undercut California's recent attempts to address its genocidal past and present: in the summer of 2019, California Governor Gavin Newsom offered a formal apology for the California Genocide and promised to work towards "truth and healing" with California's Indigenous peoples. Yet, extractive water projects continue to move forward and fish kills continue to unfold across the state. Pit River scholar-activist Morning Star Gali (2019) responded to Newsom's apology by writing that "we need more than lip service to California's tribal peoples … we need to protect our water and declining salmon populations".

The success of capitalist agriculture in California's Central Valley has required the extensive development of water resources and is predicated upon the ongoing dispossession of California's Indigenous peoples. Reclamation, which facilitated enclosure, settlement, and agricultural development in California, simultaneously eliminated Indigenous ecologies and produced new forms of nature according to capitalist logics of accumulation. When ecological limits to reclamation precipitated an economic crisis in California in the early 20$^{th}$ century, the state intervened to construct the Central Valley Project and secure agricultural production through water development. Representing a significant disruption to the Sacramento and San Joaquin watersheds, CVP operations have generated a metabolic rift in the hydrologic cycle and contributed to serious declines in water quality and fisheries across the Central Valley and Bay-Delta region with devastating consequences for California's salmon populations and Indigenous communities. The current trajectory of coordinated state and federal water development promises more of the same.

Our argument that California's water problems cannot be solved by the same engineering and technological "solutions" that caused them is not necessarily unique: Arax (2019), Reisner (1993), Walker (2004), and Worster (1985) all generally agree that one way or another, things cannot continue as they have without incurring serious ecological and political costs. But bringing together ecological Marxist frameworks and settler colonial theory through historical analysis points us to new conclusions. If the logics of accumulation and elimination are fundamentally embedded in California's water development, then any real solution to California's multidimensional water problems must address both the root structures of settler colonialism and capitalism. Reciprocal restoration—through salmon restoration, dam removal, diversion reduction, floodplain reconnection, fire reintroduction, and the return of stolen land—offers a method to simultaneously

begin closing the hydrologic rift and promote Indigenous futurities. With drought again gripping California and salmon populations under existential threat, it is a timely and necessary task.

## Data Availability Statement

Data sharing is not applicable to this article as no new data were created or analyzed in this study.

## Acknowledgements

The authors would like to thank Chimaway Lopez, Lauret Savoy, Ren-yo Hwang, and Timothy Farnham for sharing their generative feedback and insight on earlier versions of this paper. Thanks also to four anonymous reviewers for their constructive comments.

## Endnotes

[1] We define drought here as a climatic irregularity intersecting with increased pressure on finite water resources so that lack of water affects human and nonhuman communities (Kallis 2008). California's climate has always shifted between wetter and drier periods, and often to extremes that disrupted settlement and production and so became codified as problems of "flood" and "drought" in need of correction (Pisani 1984; USBR 1941). One might argue that the "problem" is not so much in drought or flood as such but in planting water-intensive crops in semi-arid areas or building cities on floodplains.

[2] We recognise that highlighting elimination as the primary logic of settler colonialism is contested and not universally applicable to all settler colonial contexts. The *exploitation* of Indigenous communities, rather than elimination, can also define settler colonial states, such as those in Latin America (see Englert 2020; Speed 2017).

[3] It is beyond the scope of this paper to fully recount the California Genocide. We have not provided graphic details of any specific events in order to avoid reproducing pornotropic narratives of colonial violence. We direct interested readers to Norton (1979) and Madley (2016), who provide a detailed and careful account of the California Genocide.

[4] The legislative history of the Central Valley Project and the associated political battles around its control between various federal agencies and the state of California are well-documented (see Engle 1956; Pisani 1984; Reisner 1993; Worster 1985). These struggles and divergences are important, but for our purposes, more important is that both the federal government and the Californian state shared the common view that expansion of irrigation in the Central Valley was vital to the continued colonisation of the West.

[5] Colonial-capitalist control of fire in the context of forest management bears many similarities to colonial-capitalist control of water in agricultural contexts, and cultural burning can achieve similar cultural, political, and ecological outcomes as reciprocal salmon restoration. The return of cultural fire to California's landscapes is also crucial to salmon restoration since fires can provide smoke and clear brush which lowers stream temperature, reduces transpiration, and increases streamflow. For more on fire, see Aldern and Goode (2014), Lake et al. (2017) and Norgaard (2019).

[6] Figures were originally in colour and have been edited to preserve clarity and contrast in grayscale.

## References

Adams F (1917) "The Need for a New Land Settlement Policy in California." Frank Adams Papers, Water Resources Collections and Archives, University of California, Riverside

Adams F (1933) "Reclamation of Land." Frank Adams Papers, Water Resources Collections and Archives, University of California, Riverside
Aldern J D and Goode R (2014) The stories hold water: Learning and burning in North Fork Mono homelands. *Decolonization* 3(3):26–51
Anderson G E, Ellison W H and Heizer R F (1978) *Treaty Making and Treaty Rejection by the Federal Government in California, 1850-1852*. Socorro: Bellena Press
Anderson M K (2005) *Tending the Wild: Native American Knowledge and the Management of California's Natural Resources*. Berkeley: University of California Press
Arax M (2019) *The Dreamt Land: Chasing Water and Dust Across California*. New York: Alfred A. Knopf
Balazs C, Morello-Frosch R, Hubbard A and Ray I (2011) Social disparities in nitrate-contaminated drinking water in California's San Joaquin Valley. *Environmental Health Perspectives* 119(9):1272–1278
Black M (1995) Tragic remedies: A century of failed fishery policy on California's Sacramento River. *Pacific Historical Review* 64(1):37–70
Blythe S O (1937) Central Valley Project: California's approved solution for her greatest problem—water. *California Magazine of Pacific Business*
Cantor A (2017) Material, political, and biopolitical dimensions of "waste" in California water law. *Antipode* 49(5):1204–1222
Carroll P (2012) Water and technosciennific state formation in California. *Social Studies of Science* 42(4):489–516
CDFA (2019) "California Agricultural Statistics Review, 2018-2019." California Department of Food and Agriculture
Coulthard G (2014) *Red Skin, White Masks: Rejecting the Colonial Politics of Recognition*. Minneapolis: University of Minnesota Press
Dahl T E (1990) "Wetlands Losses in the United States 1780s to 1980s." US Department of Interior, Fish and Wildlife Service https://www.fws.gov/wetlands/documents/Wetlands-Losses-in-the-United-States-1780s-to-1980s.pdf (last accessed 11 August 2021)
Dallman S, Ngo M, Laris P and Thien D (2013) Political ecology of emotion and sacred space: The Winnemem Wintu struggles with California water policy. *Emotion, Space, and Society* 6:33–43
David N, Gluchowski D C, Leatherbarrow J E, Yee D and McKee L J (2015) Estimation of contaminant loads from the Sacramento-San Joaquin River Delta to San Francisco Bay. *Water Environment Research* 87(4):334–346
Engle C (1956) "Central Valley Project Documents." US House Committee on Interior and Insular Affairs
Englert S (2020) Settlers, workers, and the logic of accumulation by dispossession. *Antipode* 52(6):1647–1666
Etcheverry B (1933) *Irrigation Practice and Engineering*. York: Maple Press
Farley T, Reynolds F L, Mills T J, Benthin R and Low A (1993) "Restoring Central Valley Streams: A Plan for Action." California Department of Fish and Game https://www.waterboards.ca.gov/waterrights/water_issues/programs/bay_delta/wq_control_plans/2006wqcp/exhibits/append2/doi/doi-45m.pdf (last accessed 11 August 2021)
Foster J B (1999) Marx's theory of metabolic rift: Classical foundations for environmental sociology. *American Journal of Sociology* 105(2):366–405
Foster J B, Clark B and York R (2010) *The Ecological Rift: Capitalism's War on the Earth*. New York: Monthly Review Press
Gali M S (2019) Gov. Newsom needs to give more than lip service to at-risk California native tribes. *The Sacramento Bee* 18 November
Garibaldi A and Turner N (2004) Cultural keystone species: Implications for ecological conservation and restoration. *Ecology and Society* 9(3) https://www.ecologyandsociety.org/vol9/iss3/art1/ (last accessed 11 August 2021)
Goldstein J (2012) Terra economica: Waste and the production of enclosed nature. *Antipode* 45(2):357–375
Hall W H (1876) "Ledger A: Irrigation 1870s." William Hammond Hall Collection, California State Library

Hall W H (1891) "The Irrigation Age and Western Empire." William Hammond Hall Collection, California State Library
Harding S T (1960) *Water in California*. Palo Alto: N-P Publications
Hyatt E (1938) The Central Valley Project of California. *Journal of the American Water Works Association* 30(3):389–401
Isenberg A (2005) *Mining California: An Ecological History*. New York: Hill & Wang
Kallis G (2008) Droughts. *Annual Review of Environment and Resources* 33:85–118
Kimmerer R (2011) Restoration and reciprocity: The contributions of traditional ecological knowledge. In D Egan (ed) *Human Dimensions of Ecological Restoration: Integrating Science, Nature, and Culture* (pp 257–276). Washington, DC: Island Press
Kingston L (2015) The destruction of identity: Cultural genocide and indigenous peoples. *Journal of Human Rights* 14(1):63–83
LaDuke W and Cowen D (2020) Beyond Wiindigo infrastructure. *South Atlantic Quarterly* 119(2):243–268
Lake F K, Wright V, Morgan P, McFadzen M, McWethy D and Stevens-Rumann C (2017) Returning fire to the land: Celebrating traditional ecological knowledge and fire. *Journal of Forestry* 115(5):343–353
Lindsay B (2012) *Murder State: California's Native American Genocide 1846–1873*. Lincoln: University of Nebraska Press
Longo S B, Clausen R and Clark B (2015) *The Tragedy of the Commodity: Oceans, Fisheries, and Aquaculture*. New Brunswick: Rutgers University Press
Madley B (2016) *An American Genocide: The United States and the California Indian Catastrophe, 1846-1873*. New Haven: Yale University Press
Marshall R B (1919) "Irrigation of 12 Million Acres in the Valley of California." California State Irrigation Association
Martinez D (2003) Protected areas, Indigenous peoples, and the Western idea of nature. *Ecological Restoration* 21(4):247–250
Marx K (1990) *Capital, Volume I*. New York: Penguin
Marx K (1991) *Capital, Volume III*. New York: Penguin
Marx K (1993) *Grundrisse*. New York: Penguin
Mead E (1903) *Irrigation Institutions: A Discussion of the Economic and Legal Questions Created by the Growth of Irrigated Agriculture in the West*. New York: Macmillan
Middleton-Manning B R, Gali M S and Houck D (2018) Holding the headwaters: Northern California Indian resistance to state and corporate water development. *Decolonization* 7 (1):174–198
Moyle P B, Katz J V E and Quiñones R M (2011) Rapid decline of California's native inland fishes: A status assessment. *Biological Conservation* 144(10):2414–2423
Moyle P B, Lusardi R and Samuel P (2017) "State of the Salmonids II: Fish in Hot Water." California Trout https://caltrout.org/sos (last accessed 11 August 2021)
Norgaard K M (2019) *Salmon and Acorns Feed Our People: Colonialism, Nature, and Social Action*. New Brunswick: Rutgers University Press
Norton J (1979) *Genocide in Northwestern California: When Our Worlds Cried*. San Francisco: Indian Historian Press
O'Connor J (1988) Capitalism, nature, socialism: A theoretical introduction. *Capitalism, Nature, Socialism* 1(1):1–22
O'Connor J (1998) *Natural Causes: Essays in Ecological Marxism*. New York: Guilford Press
Pesonen E A (1953) "The San Joaquin Salmon Story—Division of Irrigation and Power, Bureau of Reclamation, US Department of the Interior." Martin H. Blote Papers, Water Resources Collections and Archives, University of California, Riverside
Pisani D (1984) *From Family Farm to Agribusiness: The Irrigation Crusade in California and the West 1850–1931*. Berkeley: University of California Press
Polanyi K (1944) *The Great Transformation: The Political and Economic Origins of Our Time*. Boston: Beacon
Prokopovich N P (1989) "Irrigation History of the West Central San Joaquin Valley." San Joaquin Valley Drainage Program, US Bureau of Reclamation

Reisner M (1993) *Cadillac Desert: The American West and Its Disappearing Water* (2nd edn). New York: Penguin
Rolph J (1931) "Message to the People of California Dealing With Their Water Problem." Courtesy Special Collections of the Sacramento Public Library
Rosenstock T S, Liptzin D, Six J and Tomich T P (2013) Nitrogen fertiliser use in California: Assessing the data, trends, and a way forward. *California Agriculture* 67(1):68–79
Scott J (1998) *Seeing Like a State: How Certain Schemes to Improve the Human Condition Have Failed*. New Haven: Yale University Press
Simpson L B (2017) *As We Have Always Done: Indigenous Freedom through Radical Resistance*. Minneapolis: University of Minnesota Press
Sisk C (2001) "Address to the United Nations Permanent Forum on Indigenous Issues."
Sisk C, Mulcahy G, Miyoshi M and Cummings C H (2019) "Letter from Winnemem Wintu Tribe to Stantec re. The Shasta Dam Raise Project." https://www.friendsoftheriver.org/wp-content/uploads/2019/01/Scoping-Comments-on-WWD-CEQA_A1b.pdf (last accessed 11 August 2021)
Smith D (1995) "The History of the Indians of Shasta County."
Smith N (2008) *Uneven Development: Nature, Capital, and the Production of Space* (3rd edn). Athens: University of Georgia Press
Speed S (2017) Structures of settler capitalism in Abya Yala. *American Quarterly* 69(4):783–790
Surprise K (2018) Preempting the second contradiction: Solar geoengineering as spatiotemporal fix. *Annals of the American Association of Geographers* 108(5):1228–1244
Tuck E, McKenzie M and McCoy K (2014) Land education: Indigenous, post-colonial, and decolonising perspectives on place and environmental education research. *Environmental Education Research* 20(1):1–23
USBR (1941) "Central Valley Project: Irrigation, Flood Control, Power." US Bureau of Reclamation
USBR (1999) "Central Valley Project Improvement Act Programmatic Environmental Impact Statement." US Bureau of Reclamation
Walker R (2004) *The Conquest of Bread: 150 Years of Agribusiness in California*. New York: New Press
Water Project Authority (1941) "Data and Information on the Central Valley Project and the Great Central Valley of California." Courtesy Special Collections of the Sacramento Public Library.
White M (1940) We're moving the rain. *Saturday Evening Post* 27 April
Whyte K P (2013) On the role of traditional ecological knowledge as a collaborative concept: A philosophical study. *Ecological Processes* 2 https://doi.org/10.1186/2192-1709-2-7
Whyte K P, Caldwell C and Schaefer M (2018) Indigenous lessons about sustainability are not just for "all humanity". In J Sze (ed) *Sustainability: Approaches to Environmental Justice and Social Power* (pp 149–179). New York: NYU Press
Woelfle-Erskine C (2019) Fishy pleasures: Unsettling fish hatching and fish catching on Pacific frontiers. *Imaginations* 10(1):325–352
Wolfe P (2006) Settler colonialism and the elimination of the native. *Journal of Genocide Research* 8(4):387–409
Worster D (1985) *Rivers of Empire: Water, Aridity, and the Growth of the American West*. Oxford: Oxford University Press
Yazzie M and Risling-Baldy C (2018) Indigenous peoples and the politics of water. *Decolonization* 7(1):1–18
Yurok Tribe (2021) "Catastrophic Juvenile Fish Kill Unfolds in Real Time on the Klamath River." Press release, 13 May